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Book Review

Spotlight on modern transformer design, P. Georgilakis. Springer, London (2009).

Transformer design has been a subject of research work for many years and it continues being a subject of interest [1–26]. In the last two decades, a total of 2000 papers have been published on transformers (24 international journals were investigated). It reveals that transformer remains an active research area.

Increasing competition in the global transformer market has put tremendous responsibilities on the industry to increase reliability while reducing cost. With this book Prof. Pavlos Georgilakis contributes to the diffusion of power transformer design in a fresh way. More specifically, Spotlight on Modern Transformer Design introduces a novel approach to power transformer design using artificial intelligence (AI) techniques in combination with finite element method (FEM). Today, AI is widely used for modeling nonlinear and large-scale systems, especially when explicit mathematical models are difficult to obtain or completely lacking. Moreover, AI is computationally efficient in solving hard optimization problems. On the other hand, FEM is particularly capable of dealing with complex geometries, and also yields stable and accurate solutions.

The main objective of this book is to solve the transformer design optimization (TDO) problem using various methods. First, TDO is solved using the conventional multiple design method. Moreover, TDO is solved combining advanced numerical methods such as finite element method and efficient optimization algorithms such as sequential quadratic programming, the branch-and-bound technique, and genetic algorithms.

Another very interesting aspect of this book is the detailed treatment of transformer selection by electric utilities and industrial users based on the total owning cost (TOC) method, and the incorporation of the environmental cost of transformer losses into the TOC method.

One more strong point is that many numerical examples throughout the book clearly illustrate the application of the techniques discussed to a variety of real-life transformer design problems.

This reference book presents practical and useful information about transformer design. The industrial experience of the author is reflected in the book in many detailed practical examples. Along with all the practical design examples, the book is filled with significant figures and tables. Prof. Georgilakis is author of three papers per year in international refereed journals during his sixteen years of professional experience, which is an excellent performance. He has theoretical and practical experience in power transformer field. This ensures the theoretical and practical treatment given to his book.

The material of the book is organized in eight chapters grouped in three parts. Part I of the book contains two chapters, and Parts II and III contain three chapters (3–5 and 6–8, respectively). Chapter 1 presents basic transformer theory (magnetic circuit, equivalent circuit, transformer operation, standards, tests and transformer types). Chapter 2 is devoted to the description of the conventional multiple design method for the solution of TDO problem. Chapter 2 presents the design of shell-type, three-phase distribution transformers to obtain the manufacturing specifications. The method is simple, efficient and accurate. By an exhaustive analysis it is concluded that the obtained solution can be the global optimum. Part II presents all the evaluation and optimization techniques that are applied in the third part of the book for transformer design. In Part III, Chapter 6 shows how to apply artificial neural networks to predict no load-losses as well as how to apply FEM to compute impedance voltage. Chapter 7 presents four methods that solve practical design problems of three-phase wound core type transformers: TDO; winding material selection (cooper or aluminum); and grouping small and large cores so as the total no-load loss of the transformers batch is minimized. Chapter 8 deals with transformer selection.

Who should read this book? Transformer designers and researchers engaged in optimization and quality enhancement activities in today's competitive environment, utility engineers who want to know more about transformer selection and professors in electrical engineering who want to integrate the traditional transformer theory with modern transformer design.

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